**RESEARCH ARTICLE**

# Prevalence of canine cutaneous neoplasms from Shiraz, Iran

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**ABSTRACT**

The present study was conducted on 42 dogs with a histopathological diagnosis of skin neoplasia presented in the Shiraz University Veterinary Clinic from April 2012 to December 2017. All cases were reviewed, excluding the mammary gland neoplasms. The histopathological type, prevalence, sex, age, breed and site distribution of the neoplasms were described. In addition, previous studies on canine skin tumors from other geographic regions were evaluated and compared with the results of the present study. Fifteen different histopathological types of tumor were diagnosed. The prevalence of epithelial, mesenchymal, melanocytic and lymphohistiocytic tumors was 61.9%, 35.7%, 2.4% and 0 %, respectively. The three most common tumors were sebaceous gland adenoma (21.42%), squamous cell carcinoma (11.9%), and lipoma (11.9%). The incidences of these tumors were more than other researches. Although there is no obvious explanation for these geographical differences, the possible reasons may be the geographical locations, environmental influences, and the study population and breed. Terriers were the most common type of the dogs in this study (34.4%). The present findings about the dogs age and various skin tumors and the anatomical locations indicates that there is no significant variation in these important parameters among the Iranian dogs and dogs from other parts of the world.

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## Introduction

Neoplastic conditions in dogs can involve the skin, which is the largest organ system of the body [1, 2]. Several studies have been published about the relative incidence, predilection sites, and the effects of age, sex and breed on different skin tumors of dogs from different geographic regions like Denmark [3], United Kingdom [4], USA [5], Greece [6], Grenada [7] and Zimbabwe [8]. It is important to demonstrate the regional variations in the occurrence and type of tumors that appear in dogs. For example, cutaneous histiocytoma has been the most frequently reported neoplasm in dogs in India and Zambia [9, 10]; lipoma was the most common skin tumor in dogs in Korea [11], and mast cell tumor ranked first in studies on dogs from Thailand, Denmark, Greece, Brazil, and Zimbabwe [1, 3, 6, 8, 12].

The exact reasons for these differences are not well understood. The reports show remarkable differences in various geographic regions that could be related mainly to climate, ultraviolet radiation (environmental carcinogenic exposure) and the breeds of dogs (differences in genetic susceptibility) as risk factors for some types of cutaneous tumors [13, 14].

According to our knowledge, there is no available and clear information on the canine cutaneous tumors in Iranian dogs. Thus, the aims of the present study were to identify the most common histologic types of canine cutaneous tumors, tumor frequency, age, sex and site distribution of a defined geographical area. These objectives can be used as a source of histologically confirmed cases for epidemiologic and laboratory studies. There are also comparisons between our findings with the results of surveys in other countries.

## Results

Among the 42 neoplastic skin masses examined, fifteen different cutaneous neoplasms were recognized. Of these, 26 (61.9%) were of epithelial origin (8 types), 15 (35.7%) of mesenchymal origin (6 types), 1 (2.4%) of melanocytic origin (1 type) and no lymphohistiocytic origin were seen (Tables 1 and 2). Among the tumors, 8 (19.05%) were malignant whereas 34 (80.95%) were benign (Table 2).

The frequency, mean age in years, and male-to-female ratio of each neoplastic tumor type was shown (Table 1). The three most common tumors were sebaceous gland adenoma (9, 21.42%), squamous cell carcinoma (5, 11.9%), and lipoma (5, 11.9%). These three tumors comprising 45.22% of all cutaneous neoplasms diagnosed during the study (Table 1). The

sebaceous gland adenoma was the most common tumor of all cutaneous neoplasms diagnosed during this period.

The mean age of affected dogs for all neoplasms except papilloma varied between 5.2 years (for haemangiopericytoma) and 11.5 years (for hepatoid gland adenoma and mast cell tumor) (Table 1). Tumors of epithelial and mesenchymal origin had a close mean age of occurrence (8.15 and 8.53 years, respectively).

Terriers were the most common type of dogs in this study (34.4%). Four of five cases of lipoma and half of the cases of sebaceous gland adenoma were observed in Terriers. Other breeds represented in this study in descending order of frequency were mixed breed dogs (sheep dogs) (9), German Shepherd Dog (7), Poodles (2), Pekingese (2), Labrador retriever (1), Great Dane (1), Maltese (1), Boxer (1), Shih Tzu (1), Miniature Pinscher (1) and Spaniel (1).

Skin tumors were most frequently located on the head and neck (16), followed in descending order by trunk (12), limbs (11), and multiple sites (3) (Table 3). Among the malignant tumors, 6 of 8 were found in the
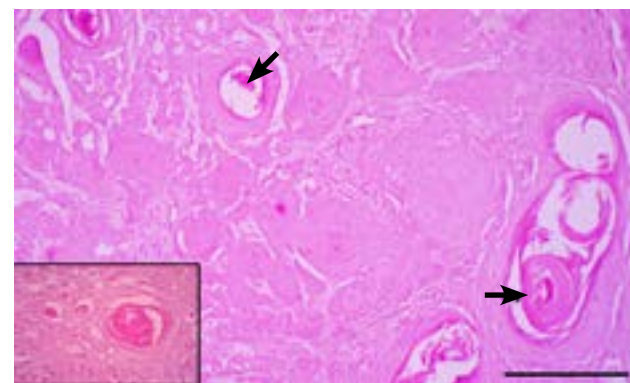


**Figure 1**
Squamous cell carcinoma. Cords and islands containing of large cells with abundant eosinophillic cytoplasm, ovoid nuclei with a prominent nucleolus, and keratin pearls (arrows). H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, 400x.
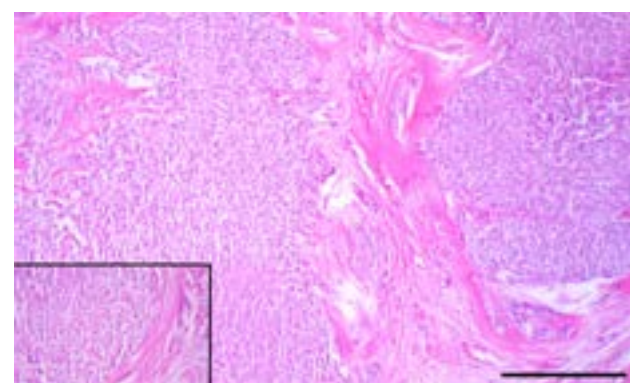


**Figure 2**
Trichoepithelioma. The round to oval neoplastic cells with lightly eosinophilic cytoplasm and vesicular nuclei and accumulation of keratin. H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, 400x.
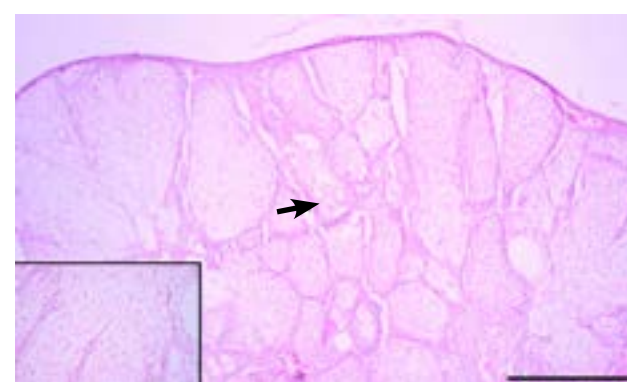


**Figure 3**
Sebaceous adenoma. Multiple lobules composed of the neoplastic cells with abundant pale, vacuolated cytoplasm, centrally hyperchromatic nuclei, surrounded by a rim of small, basophilic reserve cells (arrow). H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, ×400.
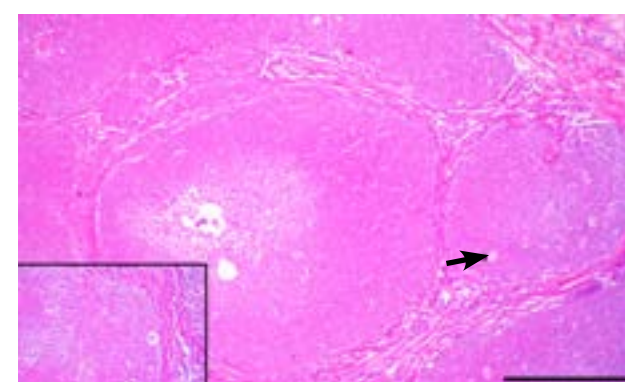


**Figure 4**
Sebaceous carcinoma. The neoplastic cells with moderate amount of cytoplasm and hyperchromatic, pleomorphic nuclei with prominent nucleoli. Some of these cells contained intracytoplasmic lipid vacuoles (arrow). H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, ×400.
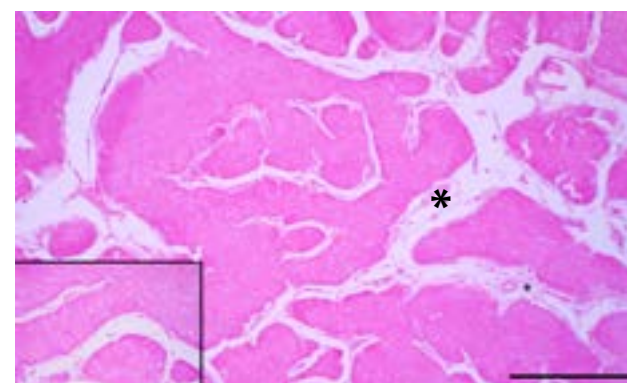


**Figure 5**
Hepatoid gland adenoma. The polyhedral neoplastic cells with centrally, large, ovoid nuclei with a central nucleolus, abundant eosinophilic cytoplasm and distinct cell borders (resembling hepatocytes), with a fibrovascular stroma (*). H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, 400x.



**Figure 6**
Infundibular Keratinizing Acanthoma. The tumor consisted of a cyst (*) lined by a keratinized stratified squamous epithelium ({). H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, 400x.
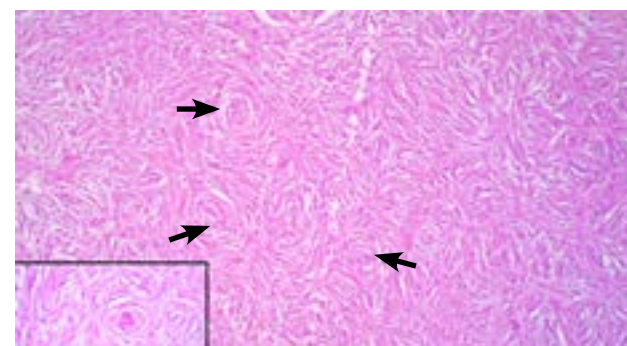


**Figure 7**
Hemangiopericytoma. Spindle shaped cells arranged around a central capillary in a fingerprint pattern (arrows). H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, 400x.
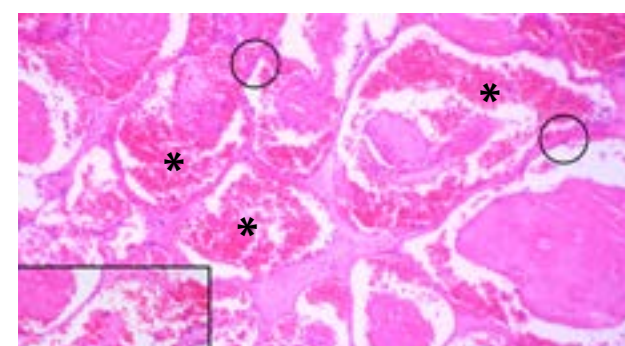


**Figure 8**
Hemangioma. Variably sized vascular spaces filled with erythrocytes (*) and lined by a layer of uniform endothelial cells (circles). H&E. Scale bar=100 μm. Inset shows the high magnification of tumor cells, 400x.
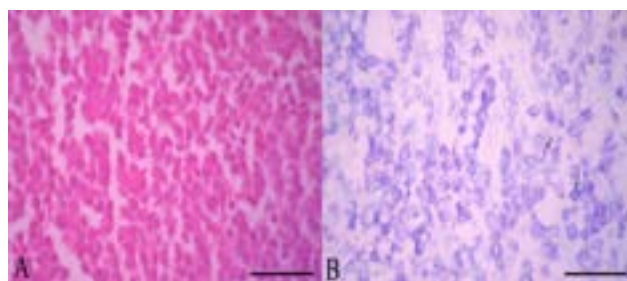
**Figure 9**
Mast cell tumor. A) Round to polygonal neoplastic cells with moderate amount of cytoplasm and round central to slightly eccentric nuclei. H&E. Scale bar=100 µm. B) Fine metachromatic granules (arrows) dispersed in the cytoplasm. Toluidine blue. Scale bar=100 µm.

head and neck.

Indicative photomicrographs of some cutaneous tumors recorded in the present study are also presented (Figures 1-9).

## Discussion

The results of this survey in Shiraz are compared with those from Zimbabwe, Greece, Denmark, Korea, Thailand and the USA (Table 4). In the present study, the most common tumors were sebaceous gland adenoma, squamous cell carcinoma, and lipoma. These three tumors comprised near half of the all diagnosed cutaneous neoplasms. The incidences of these tumors were far more than the other researches [1, 4-6, 8, 11, 12]. There is no obvious explanation for these geographical differences. The squamous cell carcinoma prevalence (11.9%) was close to a survey in Zimbabwe (15.4%) [8]. Squamous cell carcinoma was the second most common tumor in both studies. A possible explanation may be in the environmental influences. Zimbabwe and Shiraz lie in the subtropics and most dogs are kept outdoors and therefore have greater exposure to sunlight. Other tumors, such as haemangiosarcomas and hemangioma, that have been associated with increased exposure to UV light in humans and domestic animals [6] were also seen in both studies. However, a study in tropical Queensland found no increase in UV light-associated tumors number compared with other regions [15]. The discrepancies between these data and the results obtained from previous studies in relative incidence of these diagnosed tumors may be related mainly to differences in the classification system, the diagnostic criteria, the geographical locations and environmental influences, and the breed and study population.

The majority of the diagnosed tumors in the current study were benign (80.95%) in nature, and this finding was in accordance with earlier reports [16, 17]. The percent of malignant tumors (19.05%) was less than the percent detected in Zimbabwe (37%) and Denmark (42.48) [3, 8].

Among Skin tumors, 61.9% and 35.7% were of epithelial origin and mesenchymal origin respectively. Prevalence of skin epithelial versus non-epithelial tumors in the dog varied in different studies. In many studies [8, 18], the most common tumors (around 45-50%) were mesenchymal origin following by epithelial origin (near 40%) and melanocytic origin (5-9%). In comparison to these researches, epithelial tumors were higher in the present study. In Greece, epithelial tumors were the most common (like our finding), and constituted 48% of all skin tumors and mesenchymal tumors constituted 40% [6]. The observed differences in different countries may be a reflection of canine breed population and environmental influences.

For all skin neoplasms, except papilloma that occurs in young dogs [18], the mean age of affected dogs (Table 1) falls within the common range for the occurrence of most neoplasms in dogs, that is, 6 to 14 years [19]. According to our data, the mean age of dogs affected by skin tumors is 8.22 years. It is close to the results of similar researches in Zimbabwe [8], Korea [11], and Germany [20].

Head and neck were the most frequent location for skin tumors, followed in descending order by trunk, limbs, and multiple sites (Table 4). In many researches, trunk detected as the most common site of skin tumors; or greater prevalence of skin tumors found in female dogs. These kinds of data were determined by including mammary tumors and the high prevalence of mammary neoplasms in bitches and also different classifications used by researchers [19]. In the present study, the mammary gland neoplasms were excluded. Due to a limited number of cases for each tumor, drawing valid conclusions on the sex, age, breed and anatomical locations predilection for the most frequently diagnosed tumors were not possible in our overall population. However, the present finding about the dogs age and various cutaneous tumors and anatomical locations shows that there is no significant difference in these important parameters among the Iranian dogs and dogs from other parts of the world.

Twelve breeds, including mixed breed dogs, were represented in this study. Terriers were the most common type of dogs who presented with skin tumors, followed by mixed breed dogs and German Shepherds. Terriers are the common and popular breed in Iran. The differences on the incidence of skin tumors might have appeared due to different popularity of certain breeds in certain geographical regions. Since canine population figures for Iran are not available, relative prevalence among different breeds could not be determined; while there may be a predisposition for cutaneous tumors among some breeds.

It is necessary to document the prevalence of different tumors in various geographic areas so that more definitive information may be gathered for future use. Documented knowledge on the incidence and type of tumors helps veterinary practitioners to identify an appropriate therapy and anticipate an appropriate prognosis. After an accurate clinical examination, consideration of documented information on sex, age, breed and the histopathological report, tumors can be diagnosed in a reasonable amount of time and clinicians will be able to determine and decide on a proper treatment, and anticipate an appropriate prognosis for many patients.

This study was entirely based on clinical cases submitted from the Veterinary Medical Teaching Hospital of Shiraz University. Therefore, it is anticipated that the results of this study will reflect the prevalence and distribution of various skin tumors in the Iranian dog population. Furthermore, this result would serve as an important reference in future researches. To our knowledge, this kind of information has not been published previously for the Iranian dog population.

Based on the present finding, most of the cutaneous neoplasms in dogs from Shiraz (Iran) were epithelial-origin and the most common tumors were sebaceous gland adenoma, squamous cell carcinoma, and lipoma. Although there is no obvious explanation for differences between these results and similar research findings in other countries, the possible reasons may be the geographical locations, environmental influences, and the study population and breed. The present finding about the dogs ages and various cutaneous neoplasms and anatomical locations reveals that no significant variation is in these parameters among Iranian dogs and dogs from other parts of the world.

## Material and methods

The present study was conducted on 42 dogs of different breeds, sex and age group with skin tumors presented to the Shiraz University Veterinary Clinic from April 2012 to December 2017. Only dogs living in the Shiraz region at the time of collection of the specimens were included in the survey. All cases with a histopathological diagnosis of skin neoplasia were reviewed, excluding the mammary gland neoplasms.

Biopsies have been taken from suspected sites under general anesthesia. Specimens were fixed in 10% neutral buffered formalin, embedded in paraffin and sections stained with haematoxylin and eosin. Tumors were diagnosed and classified according to the current World Health Organization (WHO) classification of animal tumors [21, 22]. History relating to sex, breed, age, and site of the tumor were obtained. Initially, the histopathological type, prevalence, sex, age and site distribution of the neoplasms were described. The neoplasms were grouped into 4 broad classes, namely epithelial, mesenchymal, melanocytic and lymphohistiocytic. Location of the tumor on the body was categorized into 4 groups: head and neck, trunk, limbs, and multiple sites.

In addition, published studies on skin tumors of dogs from other geographic regions were evaluated and compared with the results of the present study.

## Author Contributions

Design of study: M.A.H. and F.N. Clinical sampling: M.A.H. Performed pathological studies: F.N. and F.Z.K

## Conflict of Interest

The authors declare that they have no conflict of interest.

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